THE AMERICAN MINERALOGIST
JOURNAL OF THE MINERALOGICAL SOCIETY OF AMERICA
VOL. 8 JULY, 1923 No. 7

THE COLOR OF THREE VARIETIES OF QUARTZ

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The three notes here presented are by-products of an investigation pertaining to the cause of color in rose quartz. Two of the notes have some bearing on that problem.

In the analyses given in this paper the procedure was as follows: (1) the quartz fragments were ground in an agate mortar, (2) the silica was volatilized by gentle heating with HF and H_2SO_4 acids in a platinum crucible, (3) the residue was fused with $KHSO_4$, (4) this fusion was dissolved in dilute H_2SO_4, and (5) the iron was determined by reduction to the ferrous state and titration with a dilute $KMnO_4$ solution. Titanium was colorimetrically determined. The colors of minerals and solutions mentioned below are given in terms of Ridgway's[1] color scale.

1. NOTE ON THE COLOR OF CITRINE

On preparing a number of colloidal solutions of hydrous ferric oxide, the writer was impressed by their marked resemblance in color to that of citrine. These solutions were prepared by adding a few cc. of a neutral $FeCl_3$ solution to 500 cc. of water at its boiling temperature. The color of the solutions varied with the iron content from dark red, thru orange, to light yellow, as shown in the following table. The colors given in the table were those of a thickness of 10.5 cm. of solution viewed against a white background.

TABLE I. THE COLOR OF COLLOIDAL HYDROUS FERRIC OXIDE SOLUTIONS.

%Fe_2O_3 IN THE SOLUTION	RIDGWAY'S COLOR	
0.068 %	1 i	(dark red)
.034	4 h	(red)
.0059	15 full	(orange)
.0034	17 full	(yellow-orange)
.0007	21 ″d	(pale yellow)

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[1] Robert Ridgway. Color standards and color nomenclature. Washington, 1912.

In order to determine whether the amount of iron in citrine is proportional to the depth of its color, three specimens from Brazil were analyzed for that element. Specimen No. 1 had a deep amber color, while No. 2 and No. 3 possessed about the same pale yellowish tinge, but No. 2 was slightly darker. Table II gives the results of duplicate analyses:

TABLE II. Fe_2O_3 IN CITRINE FROM BRAZIL

SPEC. NO.	RIDGWAY'S COLOR	Fe_2O_3		
		1.	2.	Aver.
1	9 k	0.029%	0.023%	0.026%
2	19 '''b	.007	.008	.008
3	21 '''f	.010	.012	.011

These results show that the iron content, in general, varies with the depth of color, altho theoretically the Fe_2O_3 percentage in No. 2 and in No. 3 should be reversed. But they are very close in color, while No. 1, decidedly darker, is much higher in iron.

A microscopic examination of fragments immersed in clove oil showed these citrines to be very clear, the only impurities, aside from bubbles, being a very few stains of limonite on one or two fragments of No. 1. These stains were not at all abundant enough to account for its much higher Fe_2O_3 content. The suggestion is offered that the color is due to submicroscopic particles of hydrous ferric oxide. If we calculate gs. Fe_2O_3/cc. of citrine and of solution it is found that the ferric hydroxide in citrine possesses about the same coloring power as in the aqueous solutions prepared by the writer. Specimen No. 1, with 0.026% Fe_2O_3 contains 0.00069 gs. Fe_2O_3/cc. $(2.65 \times 0.026 \div 100)$. It is deep amber, and a colloidal ferric hydroxide solution containing the same number of gs. Fe_2O_3 per cc. has the same color, in a layer of the thickness of the citrine specimen (1 cm.).

This suggestion as to the pigment agrees with Nabl's[2] statement that citrine has an iron oxide absorption spectrum. The loss of color on heating may be most probably accounted for by a dehydration of the hydroxide.

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[2] Arnold Nabl. *Min. petr. Mitt.*, **19**, 273–6, 1900.

2. A PINK QUARTZ CRYSTAL COLORED BY HEMATITE INCLUSIONS

Typical rose quartz is massive, of a rose-red color (equivalent to Ridgway's 67″e-67″g, "pale laelia pink"). It is always associated with granitic rocks, either in coarse pegmatites or in hydrothermal veins. Occasionally pink or grayish-pink quartz *crystals* are found, in veins of a lower temperature of formation than those of rose quartz. During the study of rose quartz the writer wished to establish the difference in cause of color between these pink crystals and typical rose quartz.

A rock crystal (locality unknown) with a phantom crystal of pinkish quartz, from the University of Michigan's determinative collections, furnished a good specimen for this purpose. The phantom, while apparently of a uniform pink color, is made up of groups of thin, colored layers parallel to the rhombohedron faces of the crystal. The color of the pink portion is a grayish-pink-purple (R. 71‴c). Under the microscope the pink layers were found to contain a fairly large number of brownish-red, irregular inclusions and bubbles. Two 1 gram samples were prepared for analysis. The powder was decidedly pink (that of rose quartz is white). The analyses showed:

	1.	2.	Aver.
Fe_2O_3	0.042	0.044	0.043%

Evidently the color is due to fine inclusions of hematite, which also accounts for the pink color of the powder. Due to unavoidable contamination of the samples by some of the colorless quartz next to the pink layers, this result is somewhat lower than the actual amount of hematite present. Ordinary rose quartz contains much less Fe_2O_3 than does this specimen, usually not over 0.01%,[3] and in rose quartz it is certainly not present as microscopic hematite particles. The cause of the color of rose quartz has not been definitely determined.

An additional confirmation of this theory as to the pigment was obtained by mixing finely ground specular hematite with sodium silicate. It was found that the hematite could be ground to better advantage if mixed with a small amount of quartz. This liquid is so viscous as to hold the hematite particles in suspension, until the mass hardens. Its color may then be very easily compared with that of the mineral. A content of 0.03% Fe_2O_3 gave the jelly a purplish-pink color (R. 67'''e) similar to that of the pink quartz crystal, and 0.06% deepened the color to 67'''d.

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[3] Analyses, by the writer, of 20 specimens of rose quartz averaged 0.0085% Fe_2O_3. Only one contained over 0.013%.

The color of such pink crystals may, then, be attributed to hematite inclusions, and this distinguishes them from true rose quartz.

3. ROSE QUARTZ WITH NUMEROUS RUTILE INCLUSIONS

Rose quartz is abundant in Deering, N. H. It occurs in veins associated with a granite, and found either in the granite or in an intruded schist. At one outcrop rose quartz veins were found near a vein of ordinary gray quartz. Both types, rose and gray, were differentiated from the same magma, formed at nearly the same time, in the same place, and have had the same geological history.

It was thought that possibly analyses of a specimen from each vein might indicate the cause for their different colors, but this was not the case. They both contained practically the same low amounts of iron and manganese characteristic of rose quartz,[4] but the rose quartz contained eight times as much TiO_2 as the gray (0.029% and 0.0038% TiO_2, respectively). However, a microscopic examination of the rose quartz fragments immersed in clove oil showed them to contain abundant long and extremely narrow inclusions of rutile. This explained the much higher titanium content of the rose quartz as compared to the gray.

This is of much interest as the rose quartz has a somewhat more bluish or bluish-gray tinge than is usual for that mineral. It is probably due to this higher TiO_2 content, as generally rose quartz contains only about 0.003%.[5] The influence of fine rutile needles upon light produces a blue color, as Watson[6] has shown for the blue quartz with 0.069% TiO_2, from Nelson Co., Va.

The fact that both the rose and the gray quartz have gone thru the same geological history casts doubt on the theory sometimes entertained, that the rose color may be due to the action of radioactive minerals or solutions on white quartz. If the rose quartz received its color in this manner there seems to be no reason why the same agency should not have also transformed the gray quartz, of the same approximate age, and in the same outcrop.

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[4] Average of 20 analyses, by the writer: MnO 0.0003%, Fe_2O_3 0.0085%.

[5] Average of writer's analyses.

[6] T. L. Watson and R. E. Beard. *Proc. U. S. Nat. Museum*, **53**, 553-63, 1917. Analysis by Robert Robertson, The Virginias, 1885, **6**, 2. Holland, (*Mem. Geol. Surv. India*, **28**, pt. 2, 138–9, 1900) is quoted by Watson as having made a similar observation on blue quartz from India.

SUMMARY

The results of a preliminary study on the cause of color in certain varieties of quartz seem to justify the following conclusions: (1) The color of citrine is probably due to sub-microscopic hydrous ferric oxide particles. (2) A pink crystal of quartz was found to differ from typical rose quartz in being colored by hematite inclusions of microscopic dimensions. It is quite likely that this explanation is generally true for all pink crystals of quartz. (3) A rose quartz from Deering, N. H., which is more bluish than most rose quartz, owes its color to an unusual content of fine rutile inclusions.

NOTE ON THE COMPOSITION OF THOMSONITE[1]

EDGAR T. WHERRY, *Bureau of Chemistry, Washington, D. C.*

Recent study of the plagioclase feldspars[2] has led to the conclusion that they represent a case of atomic isomorphism, one calcium atom being equivalent, not to two sodiums as often supposed, but to a single sodium atom; and SiO_4 not being replaced by Si_3O_8, but remaining the silicate radicle throughout the series. In this connection it seemed worth while to consider whether other instances of alleged replacement of Ca by Na_2 and of SiO_4 by Si_3O_8 were really valid. The formulas ascribed to certain of the zeolites were therefore investigated, and in one case the relations turned out to be so different from those usually recognized that a brief note seems desirable.

In Dana's System of Mineralogy the formula assigned to thomsonite is $(Na_2,Ca)Al_2Si_2O_8+5/2\ H_2O$, with the ratio of $Na_2 : Ca$ varying from 3 : 1 to 1 : 1. These data are frequently quoted, the misprint being overlooked (it should be 1 : 3). The theoretical compositions given are based on $Na_2 : Ca$ ratios of 1 : 3, 1 : 2, and 1 : 1, but not one of the twenty analyses cited agrees with the two last, and only a few approach the first. The occasional high silica is pointed out but "it does not seem possible to explain this, in all cases, by the assumption of free quartz." Clarke[3] noted that the excess silica might be in "solid solution" or else as trisilicate groups.

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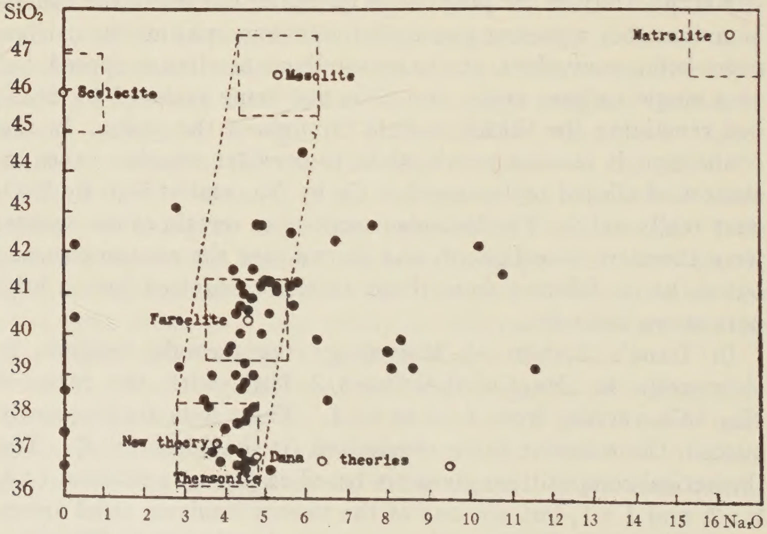
[1] Read at the meeting of the Mineralogical Society of America, December 29, 1922.

[2] *Am. Min.*, 7, 113-121, 1922.

Doelter[4] cited 67 analyses (a few obviously erroneous, or duplicates) and referred favorably to Tschermak's interpretation that there are represented in thomsonite two substances, $H_4Na_2Al_2Si_2O_{10}\cdot 3H_6CaAl_2Si_3O_{13}\cdot Aq$ and $H_4Na_2Al_2Si_2O_{10}\cdot 3H_4CaAl_2Si_2O_{10}\cdot Aq$. It would require rather convincing proof before the existence of any such complexities as these in a widespread, well crystallized mineral could be accepted.

The two points of interest being the variation in the silica and in the soda contents, it seemed that some light might be thrown on the relationships by plotting SiO_2 against Na_2O in all reasonably dependable analyses of the mineral available.[5] This is done in figure 1. Analytical figures are indicated by dots surrounded by circles, theoretical values by small squares. As the probable error in mineral analyses in general is perhaps one per cent

FIGURE 1. GRAPHICAL REPRESENTATION OF THE COMPOSITION OF THOMSONITE



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[3] *Bull. U. S. Geol. Survey*, **588**, 45, 1914.

[4] *Handbuch der Mineralchemie*, **2**, no. 13, 16-29, 1919.

[5] As the alumina and water are practically constant thruout and as the lime varies inversely as the soda, nothing would be gained by including them in the diagram.

of most constituents, dash lines have been drawn around the theoretical values at the corresponding distances.

This diagram shows, first, that the majority of thomsonites are essentially uniform in soda content. The bulk of the analysis-spots, including all of the most dependable ones, fall in a narrow strip extending up and down, with a slight slope toward the right. There being practically no zeolites containing less silica than thomsonite, admixture or solid solution of which could lower the SiO_2 content, it seems reasonable to accept its composition as indicated by a point lying toward the bottom of this strip. The Dana theory for $Na_2 : Ca = 1 : 3$ lies at its right-hand edge, but a somewhat simpler one with the ratio of these constituents 1 : 4 falls more nearly in its center, and may be accepted as the probable formula of normal thomsonite:

$Na_2O{\cdot}4CaO{\cdot}5Al_2O_3{\cdot}10SiO_2{\cdot}12H_2O$ or $NaCa_2(Al_5Si_5O_{20}).6H_2O$.

The atomic weights of silicon and aluminium not being known with sufficient certainty to justify extending the calculated values to more than one decimal place, the theoretical composition may be stated as: SiO_2 37.3, Al_2O_3 31.6, CaO 13.9, Na_2O 3.8, H_2O 13.4, sum 100.0%.

The diagram further yields no support to the view that the excess of silica is due to admixed quartz, for were that the case, the strip of analyses should slope to the left, toward where the 100% SiO_2 point would be located, instead of to the right. Similarly, were an Si_3O_8 equivalent of normal thomsonite responsible for the excess silica, it would lie well to the left of the normal formula point, and lead to slope of the strip in that direction.

When the theoretical compositions of the next series of zeolites more siliceous than thomsonite are plotted in the diagram, a reasonable interpretation of the relations is made evident. The chief variation from the normal formula is plainly in the direction of mesolite (with $Ca : Na_2 = 2 : 1$). In very few of the analyses plotted was the material demonstrated to be optically homogeneous; and Bøggild[6] has observed that intergrowth of mesolite and thomsonite does actually occur. It might be inferred then that all those analyses, lying above the bottom of the strip, were made on mechanical mixtures of these two minerals.

There is, however, too dense a clustering of analysis points at about 41% SiO_2 to make it probable that mechanical mixture accounts for the excess silica. It seems more likely that a definite species intermediate between mesolite and thomsonite exists. The name "faroelite" has in fact been applied to such a mineral (Heddle, 1857); the earlier name "mesole" is incorrectly formed. Optical data should be well adapted to throwing light on this matter. The optical data on thomsonites in the literature are scanty and poor. The refractive indices usually given are, as shown by Bøgglid, not typical. Normal low-silica thomsonite from the original locality of the mineral, Dumbarton, Scotland, was accordingly examined by the immersion method and found to have $\alpha=1.520$, $\beta=1.525$ and $\gamma=1.540$. To obtain the values for faroelite, the "thomsonite" from Table Mt., Colorado was used[7] because unusually accurate analyses of it have been made, the ratio being approximately $Na_2O : CaO : Al_2O_3 : SiO_2 : H_2O = 1 : 3 : 4 : 9 : 9$, corresponding to the formula $Na_2\ Ca_3\ (Al_8Si_9O_{34}.9H_2O$, and the composition: Na_2O 4.6, CaO 12.5, Al_2O_3 30.5, SiO_2 40.3, H_2O 12.1, sum 100.0%. It proved to have much lower birefringence and indices, these rather variable from one grain to another but averaging $\alpha=1.512$, $\beta=1.513$, $\gamma=1.518$. "Gonnardite" (Lacroix, 1896) having essentially the same composition and indices, is evidently the same mineral; mesolite shows the still lower values $\alpha=\beta=1.505$, $\gamma=1.506$.

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[6] *Math.-fys. Meddelelser, Danske Vidensk. Selskab.*, 4, no. 8, 42 pp., 1922.

Since, then, faroelite is both chemically and optically distinct from thomsonite, it is apparently to be regarded as a definite mineral species. Analysis points which lie above the faroelite area in the diagram no doubt represent mixtures of it with mesolite; those lying between it and thomsonite are correspondingly to be interpreted as mixtures, or possibly solid solutions, of the two minerals.

There remain to be considered the analyses falling well outside of the thomsonite-mesolite strip. Those lying to the left are so far from this strip and separated from it by such a decided gap as to indicate that an entirely distinct mineral is represented, with little tendency to unite either isomorphously or in non-isomorphous solid solution with normal thomsonite. The earliest name given to presumably soda-free material was comptonite (Brewster, 1821), although it has also been subsequently termed chalilite, picrothomsonite, sloanite, calciothomsonite, etc. Unfortunately none of the analyses of these are sufficiently dependable to assign it a definite formula.

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[7] Material from the type collection, determined by Cross and analyzed by Hillebrand, was available for study in the National Museum collection. Similar material from Nova Scotia, recently described by Walker with analysis by Todd (*Univ. Toronto Studies, Geol. Ser.*, No. 14, p. 72, 1922) has also been examined and gives values agreeing closely with those of the Colorado mineral. These two series of analyses were made on material optically controlled and carefully purified, and are probably worth more than all those in the early literature.

The 10 or more analyses whose points lie to the right of the dense strip exhibit a tendency toward natrolite. Bøggild showed that intergrowth of natrolite and thomsonite is fairly frequent, and these analyses may well have been made on mixtures,[8] for there is no clustering of points in such a manner as to suggest that appreciable solid solution occurs between these minerals.

It is concluded, then, that much of the apparent variability in composition of thomsonite is due to the fact that two species are represented, although part of the variation, especially in cases of high soda, is due to the analyses having been made on mixtures. There is no evidence of isomorphism between calcium and sodium, nor between SiO_4 and Si_3O_8. Thomsonite appears to be a non-variable mineral, with the formula $NaCa_2(Al_5Si_5O_{20}).6H_2O$; and faroelite, which is optically distinct and deserves species rank, is probably $Na_2Ca_3(Al_8Si_9O_{34}).9H_2O$.

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[8] Practically all date from the days before the importance of optical demonstration of homogeneity was recognized, when analyses more often than not represented mixtures. The fact that simple ratios are shown by such mixtures occasionally does not render them of any value in deciding the composition of a mineral or in demonstrating the existence of isomorphism.

OPTICAL NOTES ON THOMSONITE

SAMUEL G. GORDON, *Academy of Natural Sciences of Philadelphia*

The usually quoted indices of refraction for thomsonite are the values of Des Cloizeaux[1] and Lacroix,[2] namely, $\alpha = 1.498$, $\beta = 1.503$, $\gamma = 1.525$, which were probably determined indirectly from measurements of optic axial angles and birefringences of oriented sections. In 1912, Scheit[3] described thomsonite crystals containing a nuclear crystal of natrolite, from Jakuben in the Bohemian Mittelgebirge, which gave the values, upon immersion, for yellow light: $\alpha=1.521$, $\beta=1.523$, $\gamma=1.534$; $\gamma-\alpha=.013$, $2V=49°$.

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[1] Manual de Minéralogie, 374, 1862.

[2] Lévy and Lacroix: Les Minéraux des Roches, 1888; Larsen quotes α as 1.497.

[3] *Min. Petr. Mitth.*, 31, 495, 1912.

Thru the courtesy of Mr. George Vaux, Jr., of Bryn Mawr, the writer was privileged to examine a specimen of a zeolite resembling thomsonite in his collection from Franklin Furnace, N. J. This gave the following indices for Hg yellow light: $\alpha=1.530$, $\beta=1.532$, $\gamma=1.542$; $\gamma-\alpha=.012$, all ±.001; $2V=48°$. The mineral was suspected of being new, until an analysis revealed it as calciothomsonite, with CaO : $Na_2O=5:1$.

This wide divergence from the indices given in the literature led to an optical examination of all the specimens of thomsonite in the collections of this Academy, the results of which are given below. The indices of refraction were determined by the immersion method using Hg yellow light, and the matching liquids were checked with an Abbé-Spencer refractometer.

INDICES OF REFRACTION OF THOMSONITE

	α	β	γ	$\gamma-\alpha$	all	
Franklin, N. J.	1.530	1.532	1.542	.012	±.001;	2V=48°
Kilpatrick, Scotland	1.529	1.531	1.541	.012	±.001;	2E=81°
Kaaden, Bohemia	1.527	1.529	1.540	.013	±.001;	2E=90°
Färöe Islands	1.517	1.520	1.530	.013	±.003	
Fritz Island, Pa.	1.516	.....	1.527	.011	±.003	

The Franklin Furnace, N. J., specimen consists of large, colorless, coarse radiations of thomsonite, associated with colorless, cleavable barite, on a mass of polyadelphite and axinite. The thomsonite from Kilpatrick, Scotland, occurs as radiations of coarse crystals, at times terminated when found in cavities, associated with analcite. The specimen from Kaaden, Bohemia, consists of druses of small prismatic crystals showing the forms *a* (100), *b* (010), *c* (001), and *m* (110), with a marked tendency toward more or less parallel growth. The mineral from the Färöe Islands consists of small balls, with a radiating structure. The thomsonite from Fritz Island, Pennsylvania, is similar to the Färöe mineral, excepting that the balls are seldom more than 2mm. in diameter.

During the investigation, 16 specimens labeled thomsonite, representing 12 localities were examined. Of these, 9 proved to be thomsonite, 2 were scolecite, 2 were mesolite, and 3 were natrolite. As the Academy collections may be taken as representative, the same mislabeling probably occurs in most other collections. Curators are therefore strongly urged to examine this group of radiating white zeolites.[4]

While the external appearance of these zeolites is so close as to cause confusion, their optical properties are so distinctive as to rapidly differentiate them, as may be seen by the following table.

	α	β	γ	$\gamma-\alpha$	System
Natrolite	1.480	1.482	1.493	.013	Orthorhombic
Thomsonite	1.529	1.531	1.541	.012	Orthorhombic
	1.517	1.520	1.530	.013	Orthorhombic
Faroelite[5]	1.512	1.513	1.518	.006	———
Mesolite	1.505	1.505	1.506	.001	Monoclinic?
Scolecite	1.512	1.519	1.519	.007	Monoclinic

An index liquid of n about 1.505 is the most serviceable one. Mesolite practically disappears in this liquid, while its extremely low birefrigence (.001), makes it appear isotropic. The presence of cleavage fragments showing inclined extinction would at once indicate scolecite. Natrolite and thomsonite both show parallel extinction, but may be promptly distinguished by the indices of refraction; the indices of natrolite are much lower, while those of thomsonite (and faroelite) are much higher, than the liquid used ($n=1.505$).

[4] Since preparing this paper, the writer has learned that Bøggild (*Danske Vidensk Selskab., Math.-fysiske*, 4 (8), 1922) had previously observed the existence of an error in the accepted optical data for thomsonite, and had also urged re-examination of radiating zeolites.

[5] Dr. Wherry's values for thomsonite given in the preceding paper lie between the extremes recorded in this table. The marked variability in refractive indices shown by thomsonite is noteworthy, and a correlation of the indices and composition of different specimens would seem very desirable.

NOTE ON THE FIRST DISCOVERY OF VANADINITE IN IDAHO[1]

Harold T. Stearns, *U. S. Geological Survey*

Vanadinite was discovered by the writer in a small prospect near the tunnel of the Iron Mask Mine in the Spring Mountain Mining District, Lemhi County, Idaho. This is the first reported occurrence of vanadinite in Idaho. It occurs as yellow-brown tabular crystals 2 millimeters wide and ½ millimeter thick in clusters on manganiferous limonite. All of the crystals are hexa-

[1] Published by permission of the Director of the United States Geological Survey.

gonal prisms with base and first order pyramidal faces well developed. The mineral was identified by qualitative wet methods. The Iron Mask Mine is owned by William Clark, of Gilmore, Idaho, and was at one time in operation for its lead-silver values. The rocks of the Spring Mountain Mining District are described by Umpleby[2] as being late Devonian or early Carboniferous sedimentary rocks which were mineralized in late Cretaceous or early Eocene time. The vein of the Iron Mask Mine is in blue-gray limestone and is probably a contact phenomenon caused by one of the numerous quartz diorite intrusions.

PROCEEDINGS OF SOCIETIES

NEW YORK MINERALOGICAL CLUB

Regular Monthly Meeting of March 21, 1923

A regular meeting of the New York Mineralogical Club was held in the Assembly Room of the American Museum of Natural History on the evening of March 21, at 8 P.M. The President, Dr. George F. Kunz, presided. Because of the illness of the Recording Secretary a secretary *pro tem* was appointed by the Chairman.

Mr. Wintringham announced that the Recording Secretary proposed the following for membership: Dr. W. B. Short, 342 Madison Ave.; and Dr. C. A. Smith, 342 Madison Ave. Upon motion this was referred to the Membership Committee.

The President announced the appointment of Messrs. F. I. Allen, J. P. Wintringham, and P. Walther as a Nominating Committee to report at the April annual meeting.

Dr. Kunz then introduced Dr. J. Volney Lewis, who addressed the Club on "*The Copper Minerals of New Jersey.*" Dr. Lewis pointed out that the copper minerals were found in the trap, the shales and the sandstones of the State at many localities. In the trap, notably at Chimney Rock and Bound Brook, chalcocite was the most prevalent, with some native copper and a little bornite, chalcopyrite, cuprite and stains of chrysocolla. In the shales and sandstones north of Sommerville native copper, cuprite and hydrocuprite may be found in brecciated zones along fault planes. There is a resemblance, on a small scale, of this and other New Jersey occurrences with those of the Lake Superior region. With the secondary cuprite there is also a little chrysocolla, azurite and malachite. The intensely metamorphosed shale at Griggstown contains a great deal of chalcocite. At Rocky Hill mine the black shale is spotted with chlorite pseudomorphs after iolite. The slightly metamorphosed sandstone and shales, at Arlington and Flemington, contain ore in proximity to dikes and a limited amount also occurs near and under the first lava flow. At the Bridgewater Mine native copper and occasionally native silver are found at the bottom and under the trap sheet. At New Brunswick native copper is found in sheets and masses weighing up to 30 pounds. The copper is considered earlier than the zeolites but later than the First Mountain flow.

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[2] Umpleby, J. B., Geologic and ore deposits of Lemhi County, Idaho; *U. S. Geol. Survey, Bull.* 528, p. 87.

After viewing slides illustrating the subject, a vote of thanks was given to Dr. Lewis. Mr. F. I. Allen inquired if the bleached spots in the shales mentioned as indicating the presence of copper, were due to the removal of or a chemical change in the iron. Mr. Van Esbroeck of Belgium, a visitor, made some interesting comparisons with the occurrences at Ducktown, Tenn. Mr. Oliver P. Medsger exhibited a 12 lb. specimen of chalcocite with traces of chrysocolla dug up in the cemetery south of the Arlington Mine. He stated that such masses were frequently found and that he had one in his possession weighing 30 pounds. He presented the specimen to Dr. Lewis for the Rutgers' Museum. The meeting adjourned at 10:15 P.M.

GILMAN S. STANTON, *Secretary pro tem.*

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences, May 10, 1923

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the president, Mr. Vaux, in the chair. Twenty members and three visitors were present.

Dr. Henry S. Washington of the Geophysical Laboratory, Washington, D. C., addressed the society on "*Jadeite and Acmite*," in which the results of recent investigations of the pyroxenes by Merwin and Washington were described. Jade comprises essentially two minerals: nephrite and a pyroxene. The latter is a rock composed of varying proportions of jadeite, diopside, and albite. The Burma jade is practically pure jadeite; other jades contain prominent amounts of the diopside molecule, and sometimes up to 80% albite. Up to 8%, the albite occurs in solid solution, in higher percentages it crystallizes out. The physical and chemical characters of pyroxenic jades were described, and a number of specimens exhibited. They probably represent metamorphosed nepheline syenites. Particular mention was made of American jades found in Yucatan and Mexico. They are chemically and physically distinct from Asiatic jades, and from petrographic considerations are believed to have originally been found at an unknown locality in Southwestern Mexico, Costa Rica, or Guatemala. The pyroxenes are regarded chiefly as mixtures of jadeite ($Na_2O.Al_2O_3.4SiO_2$), acmite ($Na_2O.Fe_2O_3.4SiO_2$), and diopside ($CaO.(Mg,Fe)O.Al_2O_3.2SiO_2$) molecules. There is no evidence of the existence of the hypothetical Tschermak molecule. Augite is essentially composed of the diopside and acmite molecules, with Fe_2O_3 and Al_2O_3 in solid solution. Aegirite is composed of the acmite and diopside molecules. The color of the pyroxenes seems to depend on the relative amounts of FeO and Fe_2O_3.

A letter was read from Mr. Harry A. Warford tendering his resignation as treasurer. At Mr. Warford's request the president appointed Messrs. Hallowell, Biernbaum, and Oldach to audit the books. Mr. Millson was elected treasurer to fill the unexpired term.

The secretary exhibited a Babinet goniometer, originally the property of Frederick A. Genth, which was presented to the Academy by Mr. Edward Goldsmith.

SAMUEL G. GORDON, *Secretary.*

MINERALOGICAL SOCIETY OF WASHINGTON, D. C.

The second meeting of the Washington Mineralogical Society was held as a field party on April 28, 1923. Several mineral localities near Leesburg, Virginia were visited. Ten members, W. S. Burbank, W. F. Foshag, F. L. Hess, E. S. Larsen, C. L. Ross, E. Samson, W. T. Schaller, E. V. Shannon, E. T. Wherry and R. W. G. Wyckhoff, took part. At a quarry in Leesburg a vein of datolite cut the limestone conglomerate of the Newark formation. Crystallized specimens of datolite associated with calcite and barite and an unidentified mineral were obtained together with specimens of xonotlite from the adjoining limestone. At Goose Creek the quarry is cut by a diabase sill. Shear planes carry prehnite, apophyllite, laumontite and calcite. Numerous diabase pegmatites of varying types occur and brought forth much discussion from the members of the society. They are largely plagioclase feldspar with diallage, often in plumose groups several inches long. Miarolitic cavities are abundant in the lighter colored pegmatites and carry albite, byssolite, green pyroxene, epidote and titanite. The material collected is now under investigation by Mr. E. V. Shannon of the National Museum.

W. F. Foshag, *Secretary.*

NOTES AND NEWS

Notes on Massachusetts Minerals. Ernest E. Fairbanks, *Harvard University.*

Wollastonite. The "nephrite"[1] from the old limestone quarries of Stoneham proved to be a very pure wollastonite sometimes stained by epidote. The green stained fibrous material is the only mineral present which could have been mistaken for nephrite.

Sheridanite. A white chlorite occurs as an alteration product of diallage in a coarse grained segregation in the norite of Loon Hill, Dracut. This chlorite was found to be optically positive with 2V very small and α and β approximately 1.565.

Polydymite. This nickel mineral occurs replacing the pentlandite in the ore from the Old Nickel Mine, Dracut. The microchemical tests made on polished sections of this mineral agree very well with those given by Davy and Farnham.[2]

Prehnite and other zeolites occur in the contact zone between the Merrimac quartzite and norite, near the Nickel Mine in Dracut.

Glaucophane occurs as the chief constituent of a glaucophane-oligoclase schist along the Merrimac River in Lowell. The field relations and microscopic character are such as to leave little doubt to the writer of the igneous origin of the schist.

Anorthoclase occurs as phenocrysts measuring as much as 2 cm. x 1 cm. in an alkali syenite porphyry near the water tower at Arlington Heights. An alteration product of hedenbergite in a quartz alkali syenite from Wakefield, believed to be ferroanthophyllite, was observed but was not positively identified.

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[1] Dana, E. S., The system of mineralogy of James Dwight Dana. Sixth edition (*New York* 1920) p. 1059.

[2] Microscopic examination of the ore minerals (*New York* 1920) p. 57.

ABSTRACTS: MINERALOGY

COLLOIDAL COLORING AGENTS IN THE MINERAL KINGDOM. C. Doelter. *Kolloid-Z.* **26**, 23–7, 1920.

This is a review of D.'s previously published papers on the subject. E. F. H.

THE STATUS OF THE INVESTIGATION ON THE RADIOACTIVITY OF BAVARIAN WATERS AND ROCKS, AND THE FLUORITE FROM WÖLSENBERG. F. Henrich. *Z. angew. Chem.*, I, 5–8, 13–4, 20–2, **1920.**

Analyses are given of torbernite and autunite from the Fuchsbau locality, near Leupoldsdorf; $U/Ra = 3.32 \times 10^{-7}$. Uraninite occurs at Wölsenberg in the Oberpfalz. At the same locality is found a dark violet fluorite, which gives the odor of F on grinding. It is thought that radioactive associates caused the dissociation of some fluorite to colloidal Ca (to which the color would be due), and free F.

E. F. H.

SULFUR IN COAL, GEOLOGICAL ASPECTS. Geo. H. Ashley. *Trans. Am. Inst. Mining Eng.*, **63**, 732–8, 1920.

A presentation of the various modes of occurrence of sulfur in coal.

A. S. Wilkerson.

EXPERIMENTS IN THE FORMATION OF ALUMINUM PHOSPHATES. Hans Leitmeier and Hilde Hellwig. *Festschrift C. Doelter*, 41-67, **1920.**

Samples of kaolinite, feldspar, and igneous rock were analyzed, and then treated with ammonium phosphate solutions in shaking machines for several months. Phosphate minerals similar to those observed in nature were produced. In some cases evidence was obtained that feldspar can take up P_2O_5 by an absorption process or possibly in solid solution. E. T. W.

A MICROSCOPIC STUDY OF VEIN QUARTZ. Sidney F. Adams. *Econ. Geol.*, **15**, 623-664, 1920.

A description of the microscopic characteristics of vein quartz and the relation between structure and genesis. The investigation was limited to silica of hydrothermal origin. Part one discusses (a) varieties of silica formed in hydrothermal vein deposits; (b) crystallization of silica from the hydrogel conditions; (c) structures in quartz which has crystallized in free space. Part two includes (a) structures in replacement quartz; (b) effects of strain on quartz; (c) rearrangement of silica. The essential difference in microscopic structure between deep-seated and shallow veins is in the uniformity shown. Anomalous varieties of quartz, feathered and flamboyant quartz have been found only under conditions of low temperature. Strain phenomena such as the distortion of a crystal without rupture, and recrystallization belong to the deep-seated vein types. A generalization is made that "the majority of veins now mined were at their greatest depth below the surface at the time of their formation." A. S. Wilkerson

DIAMONDS. Sydney H. Ball. *Eng. Mining J.*, **109**, 1202-8, 1920.

A survey of the localities where diamonds have been found together with a description of the minerals and rocks with which they occur. A. S. W.

NEW STUDIES ON THE COLOR CHANGES OF MINERALS BY RADIATIONS. C. Doelter. *Sitzb. Akad. Wiss. Wien*, Abt. I, **129**, 399-430; thru *Chem. Abstr.* **16**, 2636.

The following minerals were studied with respect to the effect of ultraviolet and radium radiations on their color: fluorite, quartz, topaz, halite, barite, apatite, and others. Minerals of the same species from different localities, and even different samples of the same mineral from the same locality differed in the intensity of the color and the time required to assume the color. E. F. H.

PULVERULENT MINERAL (FLUORITE) FROM DORGALI, SARDINIA. Enrico Clerici. *Atti accad. Lincei,* **29,** I, 309-12, 1920; thru *Chem. Abstr.* **15,** 1870.

This mineral exhibits thermoluminescence even under CCl_4 or acetone, and emits radiations capable of influencing photographic plates and of penetrating glass, mica, or gelatin, but not Al or black paper. This may be due to traces of rare earths. E. F. H.

AN EASY METHOD FOR IDENTIFYING TINSTONE. August Zöller. *Chem.-Ztg.,* **44,** 797-8, 1920. THE DETECTION OF TINSTONE. Wilhelm Biltz. *Chem.-Ztg.,* **45,** 325, 1921.

The mineral to be tested is placed on zinc foil and moistened with HCl. If it is tinstone (cassiterite), a grey lustrous metallic film will be deposited on the mineral. Z. states that the film is Zn, the SnO_2 acting as a cathode and causing the deposition of the Zn dissolved by the acid from the metal, the anode. B. points out that the metal is actually Sn, not Zn. E. F. H.

OCCURRENCE AND ORIGIN OF FINELY DISSEMINATED SULFUR COMPOUNDS IN COAL. Reinhardt Thiessen. *Trans. Am. Inst. Mining Eng.,* **63,** 913-31, 1920.

Sulfur in coal is largely pyrite, occurring in lenses, sheets, or globules which may be of secondary origin. The largest number of pyrite globules are found in the anthraxylon of the coal. The author concludes that the submicroscopic sulfur in coal is derived from plants. On decomposition the sulfur in the plants is set free, mainly as H_2S. This can be oxidized under strongly reducing conditions by bacteria. A. S. W.

THE GROWTH OF AN EFFLORESCENCE OF CERIUM SULFATE ON TRAVANCORE GRAPHITE. Murray Stuart. *Rec. Geol. Survey India,* **51,** 156-8, 1920; thru *Chem. Abstr.,* **15,** 1271.

Ce sulfate efforescence developed on a specimen of graphite, from Vellanad, Travancore, while it was in the Geological Museum. Altho the mineral contained monazite grains, they were unaltered, and it is thought that the Ce was present in some other form. E. F. H.

HISINGERITE. Edward S. Simpson. *J. Proc. Roy. Soc. West. Aust.,* **5,** 95-7, (1920); thru *Chem. Abstr.,* **14,** 2319.

Hisingerite occurs as a weathering product in the Edna May Deep Gold Mine, Westonia. Analysis: Fe_2O_3 36.8, SiO_2 31.6, H_2O+ 6.0, H_2O- 21.8%. The formula is considered to be $Fe_2O_3.2SiO_2.2H_2O+$adsorbed H_2O. E. F. H.

MINERALOGICAL NOTES. 12, 13. Geo. W. Card. *Rec. Geol. Survey N. S. W.,* **9,** 105-7, 175-88, 1920; thru *Chem. Abstr.,* **15,** 1272.

Occurrences of a large number of minerals and rocks in New South Wales are listed alphabetically, with notes. Analyses of anorthoclase, augite, ekmannite, emery, polybasite, amphibole asbestus, beryl, rutile, breunnerite, almandite, spessartite, joseite and orthoclase are given. E. F. H.

MINERALOGICAL NOTES. X. C. ANDERSON. *Rec. Australian Mus.*, **13,** 1–31, 1920.

The crystallography and etch figures of beryl from the Torrington district are described. It possessed low indices, and contained about 0.4% Na_2O+K_2O. The crystallography of the following minerals is given: calcite, chabazite, vesuvianite, hematite, quartz, stibnite, wolframite, monazite, cassiterite, cuprite, and mimetite. E. T. W.

SO-CALLED HYDROCASTORITE FROM ELBA. PROBO COMUCCI. *Atti accad. Lincei*, **29,** I, 264–7, 1920; thru *Chem. Abstr.* **15,** 2401.

Doubts have previously been expressed on the view that hydrocastorite is a distinct species. C. draws the conclusion from a new analysis and the physical properties that it is either a mixture of certain secondary minerals of uncertain composition, or sometimes, simply impure stilbite. E. F. H.

COBALTIFEROUS EPSOMITE AT PARKERVILLE. EDWARD S. SIMPSON. *J. Proc. Roy. Soc. W. Australia*, **6** (pt. 2), 88–92, 1920.

This mineral was found as an efflorescence on a chloritic rock. It contained only 5.7 mols. water (theory is 7). While largely a magnesium sulfate (91.78% $MgSO\ .\ xH_2O$) it contained also Co, Ni, and Cu in the order named, and $CaSO_4.2H_2O$. The low water content is due to partial loss on exposure to warm dry air.
E. T. W.

SCOLECITE AND METASCOLECITE FROM HEGEBERGE, EULAU, BODENBACH. H. MICHEL. *Festschrift C. Doelter*, **1920,** 28–40.

An analysis of a mineral from this locality, previously called okenite, agreed closely with the theory for scolecite, from which it differs in physical characters, tho having the same optical properties. It is a natural occurrence of metascolecite (obtained by Rinne in 1890, by heating scolecite). Scolecite occurs here also. It is believed that the scolecite was formed at the end of one stage of paragenesis, and was then changed into metascolecite by an increase of temperature.
E. T. W.

THE DETERMINATION OF PLAGIOCLASE BY MEANS OF FOUQUÉ'S METHOD. R. SOKOL. *Rozpravy Ceské Akad., cl.* **2, 25,** no. 3, 10 pp., 1916; *Tscher. Min. Petr. Mitt.*, **34,** 61–8, 1917; thru *Mineralog. Abstr.* **1,** 390.

The numerical values and signs of the extinction angles in sections perpendicular to γ and α are re-examined by a graphic method. The results give corrections for the values as stated by Fouqué, Rosenbusch, and Weinschenk. E. F. H.

THE OPTICAL PROPERTIES OF TWO ANDESINES. F. BECKE AND M GOLDSCHLAG. *Sitzungsber. Akad. Wiss. Wien, Math.-naturw. Kl.*, 127, Abt. 1, 473–504, 1918; thru *Mineralog. Abstr.* **1,** 391.

Optical study of previously analysed andesines from (1) St. Raphael, Esterel, France, and (2) Mayeamo, Shinano, Japan, gave:— 1. ($Ab_{57}An_{40}Or_3$) (Na light) α 1.5482, β 1.5518, γ 1.5556, 2V 90°, ext. on (010)–5.8°, on (001)–1.5°; 2. ($Ab_{54}An_{38}$-Or_8) 1.5461, 1.5498, 1.5531, 98°, –3.5°, and –0.7°. E. F. H.

THE MICAS. Zoltán Toborffy. *Prize-essay* (*Kir. Magyar Termés. Társulat*), **1916,** viii + 94 pp.; thru *Mineralog. Abstr.* **1,** 392.

Various micas from 56 Hungarian and 63 foreign localities were examined. Etch-figures, optic axial angles, pleochroism, crystal forms, and inclusions are discussed at length. E. F. H.

AGE OF THE AUTUNITES OF PORTUGAL. A. Muguet and J. Seroin. *Compt. Rend.*, **171,** 1005–6, 1920.

Two samples from near Guarda had a Ra/U ratio of 1.42 and 1.94×10^{-7}. This indicates an age between 1000 and 2000 years. E. F. H.

MINERALS HITHERTO UNKNOWN IN DERBYSHIRE. C. S. Garnett. *Nature* **106,** 148, 1920.

The minerals mentioned are: zaratite, nephrite, diabantite, cimolite, allophane, utahite (?), sulfur. E. F. H.

CUPRITE, AZURITE, AND MALACHITE FROM BÉLAVÁR, TORDA-ARANYOSER KOMITAT. Zsigmond (Siegmund) Szentpétery. *Múzeumi Füzetek, az Erdélyi Nemezti Múzeum Ásványtárának Értesitöje,* **3,** 1–7, 225–32, 1916; thru *Mineralog. Abstr.*, **1,** 386.

These secondary copper minerals occur in crystalline schists with chalcopyrite, magnetite, and limonite. E. F. H.

MINERALS IN THE NIAGARA LIMESTONE OF WESTERN NEW YORK. Albert W. Giles. *Proc. Rochester Acad. Sci.*, **6,** 57–72, 1920.

Twenty minerals are noted from this formation. E. T. W.

DESCLOIZITE FROM THE PERGUIÇA MINE, SOBRAL DA ADIÇA. Alfredo Bensaude. *Bull. Soc. Portugaise Sci. Nat.*, **8,** 154–6, 1920.

Small brown crystals occur on limestone. An analysis is given. E. F. H.

A MINERAL NEW TO NEW ZEALAND—PILOLITE. J. Henderson. *N. Z. J. Sci. & Tech.* **3,** 79–80, 1920; thru *Chem. Abstr.* **14,** 3047.

This mineral occurs in veinlets in yellow clayey sand near Mahoenui, Auckland. It is tough and leathery and splits into thin translucent flexible sheets. It is white with a faint yellowish tinge and has satiny lustre. Two analyses show it to be a hydrous Mg-Al silicate. E. F. H.

PROLONGED ACTION OF CARBONIC ACID ON SILICATES AND QUARTZ. C. Matignon and Mlle. Marchal. *Compt. Rend.*, **170,** 1184–6, 1920.

After being treated with an aqueous solution of CO_2 at a pressure of ten atmospheres, for ten years, quartz and a number of silicates were found to have been appreciably attacked. E. F. H.

HELIODOR. Alfred Eppler. *Umschau* **34,** 497–500, 1920; thru *Chem. Abstr.*, **14,** 3208.

Heliodor is beryl, yellow in color, containing 0.55% Fe_2O_3, and is equivalent to an Fe-beryl, analogous to Cr-beryl. With cathode rays in a vacuum heliodor became luminous. It was first reported in the *Z. Goldschmiedekunst*, June 7, 1913. E. F. H.